

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

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In the Matter of )  
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Mitigation of Orbital Debris in the New Space Age )  
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IB Docket No. 18-313

**PETITION FOR RECONSIDERATION OF KUIPER SYSTEMS LLC**

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## EXECUTIVE SUMMARY

Kuiper Systems LLC, a wholly owned subsidiary of Amazon.com Services LLC (collectively, “Amazon”), urges the Federal Communications Commission (“Commission”) to reconsider its April 2020 *Orbital Debris Order* to ensure that the next generation of satellites can operate safely and effectively. The United States has recognized the importance of modernizing its space safety rules in order to realize the dream of ubiquitous broadband, particularly for unserved and underserved communities. Indeed, the Commission’s recent *Orbital Debris* proceeding made significant progress in improving space safety and promoting competition in the space economy—to the benefit of consumers in the United States and around the world. But, as recent developments have underscored, the current rules do not sufficiently address space safety concerns. Despite the Commission’s expectations to the contrary, several operators have recently sought approval to launch large satellite systems in orbits that overlap with those of other similarly large licensed or proposed systems.

To maintain its leadership position in the deployment of space and satellite technology and services, the United States must take a key role in ensuring adequate space safety standards are in place as more satellites are launched. Promoting core space safety values not only benefits U.S. interests, but also preserves orbital resources for the global community. While the advanced capabilities of next-generation non-geostationary orbit (“NGSO”) systems, combined with improved space situational awareness and space traffic management, may eventually permit multiple large NGSO constellations to share the same orbit, such technologies and framework do not yet exist. As things stand, a new Commission rule is necessary to ensure that the entities operating in highly sought after orbits can do so safely, while leaving open opportunities for other nations and operators with space-based aspirations, and to provide another incentive to develop a more advanced space traffic management system. Without such a rule, NGSO applicants have

been and will continue to be tempted to take risks that would pose a threat to space safety and the space economy.

The Commission can address these concerns by expressly requiring a later-filed large NGSO constellation to maintain sufficient orbital separation from an earlier-filed large NGSO constellation. This requirement would apply to both U.S. and foreign-licensed constellations seeking U.S. market access. By adopting this rule, the Commission will remain at the forefront of space safety standards that are critical to enhancing competition in the space economy, fostering a more stable and predictable operating environment over time, and promoting investment and the efficient deployment of communications satellites. Promoting safe access to space will allow more consumers in the United States and around the world to benefit from the reliable, high-quality satellite services they need to work, learn, and stay connected into the future.

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**PETITION FOR RECONSIDERATION OF KUIPER SYSTEMS LLC**

**I. INTRODUCTION.**

Kuiper Systems LLC, a wholly owned subsidiary of Amazon.com Services LLC (collectively, “Amazon”), respectfully submits this Petition for Reconsideration of the *Orbital Debris Order*<sup>1</sup> pursuant to Section 1.429 of the Federal Communications Commission’s (“Commission”) rules.<sup>2</sup> In the *Order*, the Commission established a number of rules to promote space safety, but declined to adopt an approach proposed by a number of parties: establishing an orbital separation requirement, including for large NGSO constellations, and associated limits. The Commission appeared to believe that operators’ own interest in safe coexistence would lead them to choose non-overlapping orbits. But the opposite has proved true. In the months since the *Order* was issued, several applicants have sought approval for large NGSO constellations that would overlap with other large NGSO constellations.

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<sup>1</sup> *In re Mitigation of Orbital Debris in the New Space Age*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 4156 (2020) (“*Orbital Debris Order*” or “*Order*”).

<sup>2</sup> 47 C.F.R. § 1.429.

To remedy this situation, Amazon urges the Commission to expressly require a later-filed large<sup>3</sup> NGSO constellation to maintain sufficient orbital separation from an earlier-filed large NGSO constellation.<sup>4</sup> This requirement should apply to both U.S. and foreign-licensed constellations seeking U.S. market access. By adopting this rule, the Commission will foster a more stable and predictable environment, as well as promote investment and the efficient deployment of NGSO systems. The Commission will also help ensure that consumers in the United States and around the world enjoy increased access to reliable, high-quality satellite services with fewer disruptions and increased capacity.

## **II. FACTS NOT EXISTING AT THE TIME THE COMMISSION ADOPTED THE *ORBITAL DEBRIS ORDER* WARRANT RECONSIDERATION.**

The Commission should reconsider the *Orbital Debris Order* in light of developments since it was adopted. Reconsideration is appropriate where a petitioner “raises additional facts not known or not existing until after the petitioner’s last opportunity to respond.”<sup>5</sup> In this case, in the short time since the Commission issued the *Orbital Debris Order*, operators have already filed a

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<sup>3</sup> The public interest requires that the Commission engage in a balancing act between maximizing opportunities for the deployment of space services and the safe and sustainable use of space. This balance will no doubt change over time, as technology improves. In the interest of simplicity, we suggest that 300 satellites may be an appropriate threshold for when a constellation becomes “large.” We would encourage other proposals from stakeholders for when the number of overlapping satellites from two different constellations may become unsafe, and thereby be required to remain appropriately separated.

<sup>4</sup> Throughout this petition, Amazon uses the term “constellation” to refer to groups of satellites that are synchronized and under common control, including those groups that are composed of more than one nominal constellation authorized under the Commission’s rules. In general, synchronous constellations under common control do not raise the same space safety issues that Amazon’s proposed rule is intended to address.

<sup>5</sup> See *In re Complaint of Lankenau Small Media Network, Inc. Against Ohio Cablevision Network, Inc. d/b/a TCI Cablevision of Ohio, Request for Carriage of WDFM-LP, Defiance, Ohio*, Memorandum Opinion and Order, 13 FCC Rcd 4497, 4500 ¶ 13 (C.S.B. 1998).

series of applications and license modifications for new large NGSO constellations that would overlap with other large NGSO constellations—contrary to the Commission’s assumptions in the *Order* that operators would avoid doing so in the interest of safe coexistence.<sup>6</sup> These applications constitute facts that did not exist at the time the Commission adopted the *Order* and warrant reconsideration.

As an active participant in the Commission’s *Orbital Debris* proceeding, Amazon supports the Commission’s efforts to pave the way for next-generation satellites while ensuring NGSO systems are able to operate safely and effectively.<sup>7</sup> Amazon recognizes that the Commission took several important steps in the *Orbital Debris Order* towards ensuring that space remains “viable for future satellites and systems and the many services that those systems provide to the public.”<sup>8</sup> These efforts include, for example, the revisions to section 25.114(d)(14), which requires those seeking to launch an NGSO satellite to provide, among other things, certain information regarding the risk of accidental collision, mitigation measures, and the steps taken towards coordination<sup>9</sup> to the extent a space station operator is relying on coordination with another system.<sup>10</sup> While this rule would allow the Commission to collect important information, it does not offer clear guidance

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<sup>6</sup> *Orbital Debris Order*, 35 FCC Rcd at 4177 ¶ 47.

<sup>7</sup> Reply Comments of Amazon.com, Inc., IB Docket No. 18-313 (May 6, 2019); Letter from Mariah Dodson Shuman, Corporate Counsel, Kuiper Systems LLC, an Amazon subsidiary, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-313 (Apr. 16, 2020).

<sup>8</sup> *Orbital Debris Order*, 35 FCC Rcd at 4157 ¶ 1.

<sup>9</sup> To be clear, regular spectrum sharing and coordination procedures that are used to address harmful interference concerns are not adequate to avoid physical collisions and otherwise protect space safety. The inter-operator coordination that would be able to address Amazon’s concerns would need to take place before commencing operations and requires one operator to alter its plan to operate in the overlapping orbit.

<sup>10</sup> See 47 C.F.R. § 25.114(d)(14).

as to when it is in the public interest for the Commission to deny applications in the event that the showing required by the rule is inadequate. By expressly requiring that large NGSO constellations maintain sufficient orbital separation, the Commission can supplement section 25.114(d)(14) in order to protect space safety and the space economy.

At the time it issued the *Order*, the Commission declined to adopt specific requirements regarding the separation of orbits for large NGSO constellations.<sup>11</sup> Despite several commenters' support for limiting orbital overlap and tolerance to ensure space safety,<sup>12</sup> the Commission concluded such rules were unnecessary, apparently because operators would avoid overlap in the interest of safety.<sup>13</sup> According to the Commission, “[l]arger deployments of satellites into circular [low-Earth orbits (“LEO”)] have been into separate orbital ‘shells.’ . . . in cases where two planned systems propose use of the same shell, coordination typically results in one or both systems adjusting planned orbital altitudes... rather than in the operators coordinating their operations at the same or overlapping altitude ranges.”<sup>14</sup> Based on this assumption, and despite an expressed “concern[] about the risk of collisions between the space stations of NGSO systems operating at

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<sup>11</sup> *Orbital Debris Order*, 35 FCC Rcd at 4177-78 ¶ 47.

<sup>12</sup> See, e.g., Comments of The Boeing Company at 19-21, IB Docket No. 18-313 (Apr. 5, 2019) (urging the Commission to consider limits on orbital tolerance for large satellite systems); Comments of Iridium Communications Inc. at 3-4, IB Docket No. 18-313 (Apr. 5, 2019) (supporting a prohibition on orbital overlap for NGSO constellations) (“Iridium Comments”); Comments of LeoSat MA, Inc. at 4, IB Docket No. 18-313 (Apr. 5, 2019) (same); Comments of Darren McKnight at 3, IB Docket No. 18-313 (Dec. 18, 2018) (same). This issue has come up in other contexts as well. Operators and other stakeholders have stressed that “Large LEO satellite constellations should not overlap in altitude.” T. Maclay et al. *Responsible Satellite Design and Operational Practices: A Critical Component of Effective Space Environment Management (SEM)*, at 4 (2019), <https://bit.ly/2Zmi5O6>.

<sup>13</sup> The Commission favorably cited an example of inter-operator coordination between Boeing and OneWeb, which resulted in Boeing “alter[ing] the orbital altitude of its *then-proposed* constellation.” *Orbital Debris Order*, 35 FCC Rcd at 4178 ¶ 47 n.153 (emphasis added).

<sup>14</sup> *Orbital Debris Order*, 35 FCC Rcd at 4177 ¶ 47.



similar orbital altitudes,” the Commission decided not to adopt a maximum orbital variance for NGSO constellations or a required separation between orbital locations.<sup>15</sup> Instead, it left these concerns to be addressed in the first instance through “inter-operator coordination” and, if necessary, on a “case-by-case basis” by the Commission.<sup>16</sup>

Unfortunately, events subsequent to the *Order* have shown the Commission’s confidence in inter-operator coordination of the sort required here was misplaced. In the months since the *Order* was adopted, the FCC has received a number of applications and license modifications for large NGSO constellations to operate in LEO that are already occupied—or proposed to be occupied—by other large NGSO constellations.<sup>17</sup> Some of these applicants plan to overlap the same orbital shells in which Amazon’s Kuiper System was recently approved to operate.<sup>18</sup> But

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<sup>15</sup> *Id.* at 4178 ¶ 47.

<sup>16</sup> *See id.* The Commission has historically entrusted “the choice of orbital regime and of the specific orbital parameters for any particular system to the discretion of the operator, *absent conflicting requests.*” *In re Mitigation of Orbital Debris, Second Report and Order*, 19 FCC Rcd 11567, 11588 ¶ 48 (2004) (emphasis added). Multiple requests for potentially overlapping large NGSO systems without pre-filing coordination, however, amounts to “conflicting requests.”

<sup>17</sup> For example, in May 2020, Kepler sought authority to operate a system of 360 satellites at 600 km with orbital tolerances of  $\pm 50$  km, which would overlap with several hundred of the 29,532 satellites SpaceX proposes to operate. *See* Application of Kepler Communications Inc. for U.S. Market Access Authority of a Non-Geostationary Satellite Orbit System in Ka- and Ku-band Frequencies, IBFS File No. SAT-LOA 20200526-00059 (May 26, 2020).

<sup>18</sup> *See In re Kuiper Systems LLC*, Order and Authorization, 35 FCC Rcd 8324, 8324 ¶ 2 (2020). Amazon’s constellation was carefully designed to ensure at least a 1 km separation from other large NGSO constellations. At the time Amazon filed its application on July 4, 2019, Swarm had not applied to exceed 550 km, *see In re Swarm Technologies, Inc. Application for Authority to Deploy and Operate a Non-Voice, Non-Geostationary Lower Earth Orbit Satellite System in the Mobile-Satellite Services*, Memorandum Opinion, Order, and Authorization, 34 FCC Rcd 9469, 9469-70 ¶ 2 (2019); Spire was licensed to operate up to 175 satellites simultaneously, *see Spire Global, Inc. – Grant In Part, Defer in Part*, Stamp Grant, IBFS File Nos. SAT-LOA-20151123-00078, SAT-AMD-20180102-00001, ¶ 3 (Nov. 28, 2018); *Spire Global – Grant In Part, Defer in Part*, Stamp Grant, IBFS File No. SAT-PDR-20190321-00018, ¶ 3 (Oct. 7, 2019); and Planet Labs was not authorized to operate more than 120 satellites with an apogee altitude above 550 km, *see*

this issue is certainly not limited to the orbital shells where Amazon will operate. Telesat and OneWeb, for example, recently asked the Commission for authorization to increase their respective constellations to 1,671 satellites and 47,844 satellites, in overlapping orbits.<sup>19</sup> In other words, contrary to the Commission’s apparent expectation that applicants’ own desire for space safety would lead them to voluntarily choose non-overlapping orbits, operators have done just the opposite. Once the Commission made clear the *Order* did not include a rule regarding orbital separation, operators flocked to already occupied orbits, including the orbits in which Amazon’s Kuiper System will operate. And since their filings, none of these applicants has sought to alter its proposed altitude or orbital variance to avoid overlapping with other large NGSO constellations, including the licensed Kuiper System. In this context, establishing a rule of general applicability—rather than resolving conflicts on a case-by-case basis—is more efficient and provides much needed regulatory certainty for operators.

### **III. A RULE GOVERNING ORBITAL OVERLAP FOR LARGE NGSO CONSTELLATIONS IS NECESSARY TO PROMOTE SPACE SAFETY AND ENSURE UNINTERRUPTED SERVICE TO THE PUBLIC.**

In light of these new, concerning developments since the *Order* was adopted, Amazon urges the Commission to reconsider its decision and adopt an additional rule to ensure safe separation of large NGSO constellations, as explained further below.

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*Planet Labs Inc. – Grant*, Stamp Grant, IBFS File No. SAT-MOD-20170713-00103, ¶¶ 3-4 (July 19, 2018).

<sup>19</sup> *Compare* Application to Modify Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat’s NGSO Constellation, IBFS File No. SAT-MPL-20200526-00053 (May 26, 2020) (proposing operations at an altitude of 1,015 km to 1,325 km), with Modification to OneWeb U.S. Market Access Grant for the OneWeb Ku- and Ka-Band System, IBFS File No. SAT-MPL-20200526-00062 (May 26, 2020) (proposing operations at an altitude of 1,200 km).

**A. An Orbital Separation Requirement for Large NGSO Constellations Will Improve Space Safety, Facilitate Coordination, and Promote Competition.**

The Commission should require later-filed large<sup>20</sup> NGSO constellations to have a sufficient orbital separation distance from other large NGSO constellations. Such a separation requirement would make commercial space safer and more efficient, facilitate coordination, and support deployment of multiple competing services for the benefit of the public.

A number of factors militate for a separation distance in the evolving world of satellite constellations. As noted by Iridium, maintaining a safe, stable operating environment for NGSO systems is challenging,<sup>21</sup> even before contemplating the possibility of two large NGSO constellations occupying the same space. Many different natural forces—from atmospheric drag to solar radiation—can alter non-geostationary orbits. Even a fully functional LEO satellite is subject to some amount of error and may not operate in a perfectly predictable manner. LEO also contains single satellites and smaller satellite systems with limited maneuverability or collision avoidance capabilities—that further challenge the operating environment for large NGSO systems.

The months since the *Order*'s adoption have confirmed that an additional rule is needed here. Contrary to the Commission's assumption that parties would voluntarily choose non-overlapping orbits to ensure safe coexistence, operators have proposed to "[o]perat[e] more than

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<sup>20</sup> See n.3. Amazon proposes that this rule apply only to "large" NGSO constellations because the risk of conjunction events increases with constellation size. There is of course no perfect number to delineate those constellations that pose sufficient risk to be subject to the proposed rule. Factors to consider include the conjunction risk that the constellation poses and the orbital density of the applicable plane or shell.

Orbit raising procedures or de-orbiting satellites that must transit the orbital planes of large constellations should not be included in the scope of this rule. Similarly, systems that contain the requisite number of satellites but have them spread out among various orbits do not pose the type of space safety concerns that this rule is intended to address.

<sup>21</sup> Iridium Comments at 4.

one constellation in the same volume of space.”<sup>22</sup> This, as technical experts from OneWeb, Iridium, and DigitalGlobe have observed, “is like having multiple ballet performances on the same stage at the same time. It dramatically increases operational complexity and elevates the risk of collision.”<sup>23</sup> While synchronized constellations under common control and with real-time information sharing do not pose these problems—because every satellite is performing the same ballet in a synchronized constellation—safe operation of large NGSO asynchronous systems today requires the Commission to formulate a separation value.

Amazon proposes that the Commission expressly require a later-filed large NGSO constellation to maintain sufficient orbital separation from an earlier-filed large NGSO constellation. In the interest of creating a simple and logical rule, Amazon proposes that the large NGSO constellation operator that first filed for access to a particular orbit should have priority in that orbit. The Commission may want to permit operators a window of time, perhaps 60 or 90 days, to attempt to coordinate orbits before resolving any remaining conflicts in favor of the first-to-file operator.

In the absence of a coordinated resolution, however, Amazon suggests that the Commission require any later-in-time applicants to propose new orbits that would comply with the separation rule. This separation value would take into account each system’s apogee, perigee, inclination, and orbital tolerance to establish a buffer zone between large NGSO constellations.<sup>24</sup> Because maneuver burdens are typically calculated when space objects come within 1 km of one another,

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<sup>22</sup> Timothy Maclay, Walt Everetts & Doug Engelhardt, *Responsible Satellite Operations in the Era of Large Constellations*, SpaceNews (Jan. 23, 2019), <https://spacenews.com/op-ed-responsible-satellite-operations-in-the-era-of-large-constellations/>.

<sup>23</sup> *Id.*

<sup>24</sup> A rule establishing a maximum permissible orbital variance would also reduce the likelihood of orbital speculation and facilitate the efficient deployment of large NGSO systems.

the Commission could set the sufficient separation distance at 1 km to avoid the need to calculate thousands of additional maneuvers, which furthers the goal of space safety while reducing the administrative burden on operators.

**B. Applying the Proposed Rule to U.S. and Foreign-Licensed Large NGSO Constellations Would Promote a Sustainable Use of Space.**

To ensure that the separation requirement is effective, the Commission should apply any rule it adopts on reconsideration to both U.S. and foreign-licensed large NGSO constellations that seek market access. The Commission has previously applied its rules to foreign-licensed satellites that seek U.S. market access<sup>25</sup> as well as contemplated other space safety rules that the Commission proposes to impose on foreign and domestic operators alike.<sup>26</sup> If foreign-licensed systems can evade the Commission's space safety rules, operators of large NGSO constellations will have every incentive to license abroad, which would not lead to meaningfully better space safety practices.<sup>27</sup> By applying this rule to both U.S. and foreign-licensed large NGSO constellations, in contrast, the Commission will act within its established authority to ensure that the global deployment of large NGSO constellations is conducted responsibly in a manner that promotes the sustainable use of space.

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<sup>25</sup> See 47 C.F.R. § 25.261(a) (“This section applies to NGSO [fixed-satellite service] operation with earth stations with directional antennas anywhere in the world under a Commission license, or in the United States under a grant of U.S. market access.”).

<sup>26</sup> See *In re Mitigation of Orbital Debris in the New Space Age*, Notice of Proposed Rulemaking and Order on Reconsideration, 33 FCC Rcd 11352, 11381-82 ¶¶ 85-87 (2018) (proposing that the Commission's rules “should be applicable to non-U.S.-licensed satellites seeking access to the U.S. market”).

<sup>27</sup> See, e.g., *China to Set 300-Plus-Satellite Constellation to Serve Communication*, China Daily (Feb. 23, 2018), <http://global.chinadaily.com.cn/a/201802/23/WS5a901bbfa3106e7dcc13dac3.html>.

#### IV. CONCLUSION.

The past several months have demonstrated that, absent a specific rule to the contrary, operators of large NGSO constellations will continue to apply for systems that propose to operate in orbits already licensed by other large NGSO constellations, thus threatening space safety and the space economy. Accordingly, Amazon urges the Commission to reconsider its *Orbital Debris Order* as set forth above and adopt a rule requiring large constellations to maintain orbital separation. This rule will promote space safety for large NGSO operators that are investing billions of dollars to deliver reliable, high-quality services to the public. Promoting core space safety values in this way not only fosters competition and a more predictable operating environment, but also will help ensure that Amazon and other operators can achieve their mission of delivering high-speed broadband to unserved and underserved communities in the United States and around the world.

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